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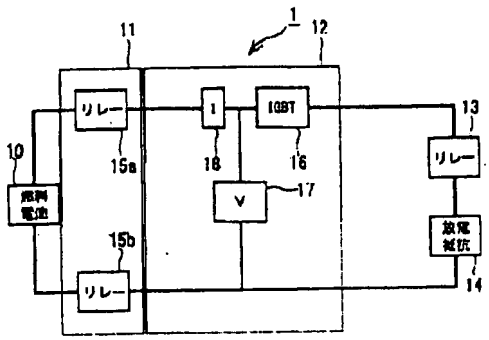
(54) FUEL CELL POWER GENERATING DEVICE

(57) Abstract:

PROBLEM TO BE SOLVED: To efficiently discharge the remaining hydrogen in a fuel cell.

SOLUTION: There are provided a fuel cell 10, a current detecting part 18 which detects a current value after stopping of power generation at the fuel cell 10, a voltage detecting part 17 which detects a voltage value after power generation of the fuel cell is stopped, a DC voltage control part 16 on the output side of the fuel cell, and a load resistor 14 on the output side of the DC voltage control part 16.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fuel cell power plant equipped with the discharge device in which the degradation phenomenon produced in the above-mentioned fuel cell after generation-of-electrical-energy actuation termination of a fuel cell power plant is prevented in detail, about the fuel cell power plant which supplies the power generated with the fuel cell to a load.

[0002]
[Description of the Prior Art] It is that the oxidant gas of the fuel gas which contains hydrogen, respectively, and the air containing oxygen is supplied to the fuel electrode which a fuel cell consists of a layered product of a unit cell, and turns into an electrode, and an air pole, and is known as what generates electricity by causing electrochemical reaction. Moreover, it is known that there is a generation-of-electrical-energy property that it is called the drooping characteristic and output voltage declines with the increment in the output current in a fuel cell.
[0003] If operation of the condition which the open-circuit voltage which is an electrical potential difference in case the output current is zero generated, i.e., a fuel cell, is changed into a halt or the condition that made it stop and the current to a load was intercepted and it is left when a fuel cell is operation appropriate temperature, an electrode catalyst particle will make it big and rough, an electrode surface product will fall, and the fall of the generation-of-electrical-energy engine performance of a fuel cell or a life will be caused.
[0004] Then, in order to avoid the degradation phenomenon of such a fuel cell, while performing operation for permuting the reactant gas in a fuel cell (fuel gas and air) by inert gas, such as nitrogen, and preventing generating of open-circuit voltage on the occasion of the shutdown of a fuel cell, the fuel cell power plant which connects discharge resistance to the output side of a fuel cell, and controlled open-circuit voltage is known.
[0005] Drawing 19 is used for below and the important section configuration of the conventional fuel cell power plant 100 is explained to it.
[0006] The fuel cell power plant 100 is equipped with the fuel cell 101, the chopper 102, the inverter 103, and the external load 104.
[0007] After constant-voltage control is carried out by the chopper 102 and the inverter 103, the power generated and outputted with the fuel cell 101 is changed into alternating current, and is supplied to the external load 104.
[0008] moreover -- as the discharge section for a fuel cell power plant 100 to control open-circuit voltage after the shutdown of a fuel cell 101 -- the output side of a chopper 102, and the input side of an inverter 3 -- ** -- it has the middle discharge device 108 which consists of the switch 106 and the discharge resistance 107 for discharging the charge stored in the intermediate-circuit capacitor 105 which it has in between, for example, is used as a capacitor for smooth of a chopper 102, and the intermediate-circuit capacitor 105.
[0009] In this fuel cell power plant 100, if a shutdown instruction is sent out to a fuel cell 101 from the control section which is not illustrated, the switch 106 of the middle discharge device 108 will be closed, the external load 104 will be intercepted, and the intermediate-circuit capacitor 105 and the discharge resistance 107 will be connected to a serial. At this time, in consideration of the charging time value of a fuel cell 101, the shutdown time amount of a chopper 102 prepares a delay circuit, and is delayed rather than the time of the external load 104 being intercepted.
[0010] In such a fuel cell power plant 100, the charge accumulated within the fuel cell 101 by the generation of electrical energy by the residual hydrogen and residual oxygen after the shutdown of a fuel cell 101 is accumulated in the intermediate-circuit capacitor 105 through a chopper 102, and discharges by the discharge resistance 107 through a switch 106 further.
[0011] Thus, degradation was made to avoid in a fuel cell power plant 100, without putting a fuel cell 101 to open-circuit voltage.
[0012]
[Problem(s) to be Solved by the Invention] However, if it is going to shorten a charging time value

when discharging the charge generated by residual hydrogen by the discharge resistance 107, it is necessary to carry out large-sized [of the discharge resistance 107], and like the fuel cell power plant 100 mentioned above, it has the middle discharge device 108 as the discharge section, and there is a problem that fuel cell power plant 100 the very thing will be enlarged in connection with it. Conversely, when a fuel cell power plant 100 is miniaturized and discharge resistance 107 is made small, there is a problem that a charging time value will become long.

[0013] Furthermore, since the cost of the fuel power plant 100 will go up like the conventional fuel cell power plant 100 if a discharge device 108 is installed, there is a problem that the manufacturing cost of the fuel cell vehicle carrying a fuel cell power plant 100 etc. will also go up.

[0014] Then, this invention is proposed in view of the conventional problem mentioned above, and aims at offering the fuel cell power plant which is a short time and can discharge certainly the charge generated with the fuel gas which remains after a generation-of-electrical-energy halt of a fuel cell.

[0015]

[Means for Solving the Problem] In order to solve an above-mentioned technical problem, in the fuel cell power plant concerning claim 1 While being constituted by an oxidizer pole and the fuel electrode on both sides of an electrolyte membrane and supplying oxidant gas to the above-mentioned oxidizer pole side The fuel cell which fuel gas is supplied to the above-mentioned fuel electrode side, and is generated, and a direct-current-voltage conversion means to change and output the power which it was prepared in the output side of the above-mentioned fuel cell, and was generated with the above-mentioned fuel cell to a direct current, It is prepared in the output side of the above-mentioned direct-current-voltage conversion means, and is characterized by having a discharge means to discharge the direct current outputted from the above-mentioned direct-current-voltage conversion means.

[0016] In the fuel cell power plant concerning claim 2, the above-mentioned discharge means may be discharge resistance.

[0017] In the fuel cell power plant concerning claim 3, the above-mentioned discharge means may be the coil prepared in the above-mentioned direct-current-voltage conversion means.

[0018] In the fuel cell power plant concerning claim 4, it is characterized by having further the control means which controls the above-mentioned direct-current-voltage conversion means to supply a direct current to the above-mentioned discharge means until the output voltage value of the fuel cell detected by electrical-potential-difference detection means to detect the output voltage value of the above-mentioned fuel cell, and the above-mentioned electrical-potential-difference detection means turns into below a predetermined value.

[0019] In order to solve an above-mentioned technical problem, in the fuel cell power plant concerning claim 5 While being constituted by an oxidizer pole and the fuel electrode on both sides of an electrolyte membrane and supplying oxidant gas to the above-mentioned oxidizer pole side The fuel cell which fuel gas is supplied to the above-mentioned fuel electrode side, and is generated, and a direct-current-voltage conversion means to change and output the power which it was prepared in the output side of the above-mentioned fuel cell, and was generated with the above-mentioned fuel cell to a direct current, A direct-current-conversion-into-ac means to change and output the direct current which was prepared in the output side of the above-mentioned direct-current-voltage conversion means, and was outputted from the above-mentioned direct-current-voltage conversion means to alternating current, A discharge means to discharge the alternating current which was prepared in the output side of the above-mentioned direct-current-conversion-into-ac means, and was outputted from the above-mentioned direct-current-conversion-into-ac means, Until the output current of the fuel cell detected by current detection means to detect the output current value of the above-mentioned fuel cell, electrical-potential-difference detection means to detect the output voltage value of the above-mentioned fuel cell, and the above-mentioned current detection means becomes below a predetermined value It is characterized by having the control means which controls the above-mentioned direct-current-conversion-into-ac means, and supplies alternating current to the above-mentioned discharge means so that it may consider as alternating current from which the output voltage detected with the above-mentioned electrical-potential-difference detection means becomes fixed.

[0020] In the fuel cell power plant concerning claim 6, the above-mentioned discharge means may

be discharge resistance.
[0021] In the fuel cell power plant concerning claim 7, the above-mentioned discharge means may be the coil prepared in the above-mentioned direct-current-voltage conversion means.
[0022] The above-mentioned discharge means may consist of a motor circuit which consumes the alternating current outputted from the above-mentioned direct-current-conversion-into-ac means in the fuel cell power plant concerning claim 8.
[0023] The above-mentioned motor circuit may consist of a power motor used as the source of power, and an auxiliary-machinery motor which drive the auxiliary machinery used since a power motor is driven in the fuel cell power plant concerning claim 9, and the above-mentioned direct-current-conversion-into-ac means may become from the direct-current-alternating current transducer for power motors which changes into the alternating current which supplies to the above-mentioned power motor, and the direct-current-alternating current transducer for auxiliary-machinery motors which change into the alternating current which supplies to the above-mentioned auxiliary-machinery motor.
[0024] In the fuel cell power plant concerning claim 10, it has the auxiliary machinery besides a power motor further, and the above-mentioned motor circuit consists of a power motor used as the source of power, is established in the output side of the above-mentioned direct-current-voltage conversion means, changes the magnitude of the direct current voltage outputted from the above-mentioned direct-current-voltage conversion means, and is further equipped with a direct-current-voltage conversion means to supply the above-mentioned auxiliary machinery.
[0025] The above-mentioned control means controls the above-mentioned direct-current-conversion-into-ac means by the fuel cell power plant concerning claim 11 to consider as the alternating current value to which the above-mentioned motor circuit does not operate.
[0026] In the fuel cell power plant concerning claim 12, the above-mentioned control means operates only the above-mentioned auxiliary machinery while controlling the above-mentioned direct-current-conversion-into-ac means to consider as the alternating current value to which the above-mentioned motor circuit does not operate.
[0027] In the fuel cell power plant concerning claim 13, while having two or more above-mentioned motor circuits as the above-mentioned discharge means, it has two or more above-mentioned direct-current-conversion-into-ac means.
[0028] It has further the fuel reforming machine which takes out the hydrogen which reforms a predetermined fuel and is supplied to the above-mentioned fuel cell, and the above-mentioned fuel cell is made to supply and generate the fuel gas taken out from residue of the above-mentioned predetermined fuel with the above-mentioned fuel reforming vessel, and it is made to discharge in the fuel cell power plant concerning claim 14.
[0029] In the fuel cell power plant concerning claim 15, it is prepared in the output side of a power are recording means to accumulate the power generated with the above-mentioned fuel cell, and the above-mentioned direct-current-voltage conversion means, and has further the relay circuit which supplies the direct current outputted from the above-mentioned direct-current-voltage conversion means to the above-mentioned power are recording means.
[0030] It has further a power accumulated dose detection means to detect the power accumulated dose of the above-mentioned power are recording means, and the above-mentioned relay circuit is controlled by the fuel cell power plant concerning claim 16 to carry out an electric power supply to the above-mentioned power are recording means based on the power accumulated dose detected with the above-mentioned power accumulated dose detection means.
[0031] The above-mentioned control means is faced suspending a generation of electrical energy of the above-mentioned fuel cell, and makes a current supply and discharge for the above-mentioned discharge means in the fuel cell power plant concerning claim 17.
[0032]
[Effect of the Invention] Since according to the fuel cell power plant concerning claim 1 it has a configuration equipped with a fuel cell and a direct-current-voltage conversion means, the power generated with the fuel cell is changed into a direct current and a direct current is discharged with a discharge means It is a short time and the charge which can change into alternating current the

with a discharge means, for example, is generated after a generation-of-electrical-energy halt of a fuel cell etc. can be discharged certainly.

[0033] According to the fuel cell power plant concerning claim 2, it is realizable to discharge certainly [are a short time and] the charge which generates it, for example after a generation-of-electrical-energy halt of a fuel cell etc. since the discharge means was considered as discharge resistance.

[0034] Since it considered as the coil in which the discharge means was formed in the direct-current-voltage conversion means according to the fuel cell power plant concerning claim 3, while discharging certainly [are a short time and] the charge generated, for example after a generation-of-electrical-energy halt of a fuel cell etc., it is not necessary to prepare the resistance which discharges to dedication, and a miniaturization and low-cost-izing of equipment can be attained.

[0035] Since according to the fuel cell power plant concerning claim 4 a direct current is supplied to a discharge means so that the output voltage detected with an electrical-potential-difference detection means may become fixed until the output current of the fuel cell detected by the current detection means becomes below a predetermined value, it is a short time and the charge generated, for example after a generation-of-electrical-energy halt of a fuel cell etc. can be discharged certainly.

[0036] While according to the fuel cell power plant concerning claim 5 being constituted by an oxidizer pole and the fuel electrode on both sides of an electrolyte membrane and supplying oxidant gas to the above-mentioned oxidizer pole side The fuel cell which fuel gas is supplied to the above-mentioned fuel electrode side, and is generated, and a direct-current-voltage conversion means to change and output the power which it was prepared in the output side of the above-mentioned fuel cell, and was generated with the above-mentioned fuel cell to a direct current, A direct-current-conversion-into-ac means to change and output the direct current which was prepared in the output side of the above-mentioned direct-current-voltage conversion means, and was outputted from the above-mentioned direct-current-voltage conversion means to alternating current, A discharge means to discharge the alternating current which was prepared in the output side of the above-mentioned direct-current-conversion-into-ac means, and was outputted from the above-mentioned direct-current-conversion-into-ac means, Until the output current of the fuel cell detected by current detection means to detect the output current value of the above-mentioned fuel cell, electrical-potential-difference detection means to detect the output voltage value of the above-mentioned fuel cell, and the above-mentioned current detection means becomes below a predetermined value It is characterized by having the control means which controls the above-mentioned direct-current-conversion-into-ac means, and supplies alternating current to the above-mentioned discharge means so that it may consider as alternating current from which the output voltage detected with the above-mentioned electrical-potential-difference detection means becomes fixed.

[0037] According to the fuel cell power plant concerning claim 6, it is realizable to discharge certainly [are a short time and] the charge which generates it after a generation-of-electrical-energy halt of a fuel cell since the discharge means was considered as discharge resistance.

[0038] Since it considered as the coil in which the discharge means was formed in the direct-current-voltage conversion means according to the fuel cell power plant concerning claim 7, while discharging certainly [are a short time and] the charge generated after a generation-of-electrical-energy halt of a fuel cell, it is not necessary to prepare the resistance which discharges to dedication, and a miniaturization and low-cost-izing of equipment can be attained.

[0039] Since according to the fuel cell power plant concerning claim 8 it has a configuration equipped with a fuel cell, a direct-current-voltage conversion means, a direct-current-conversion-into-ac means, and a motor circuit, the power generated with the fuel cell is changed into alternating current and alternating current is consumed in a motor circuit For example, it is a short time and the charge which can change into alternating current the charge generated when fuel gas etc. remains in a fuel cell after a halt of a fuel cell etc., and can discharge in a motor circuit, for example, is generated after a generation-of-electrical-energy halt of a fuel cell etc. can be discharged certainly. Furthermore, according to the fuel cell power plant concerning claim 8, it is not necessary to prepare the resistance which discharges the output voltage from a fuel cell, for example after a halt of a fuel cell etc., the motor circuit which constitutes a fuel cell system can be used, and a miniaturization and low-cost-izing of equipment can be realized.

[0040] The power motor which serves as a source of power in a motor circuit according to the fuel cell power plant concerning claim 9, The direct-current-alternating current transducer for power motors changed into the alternating current which shall consist of an auxiliary machinery motor which drives the auxiliary machinery used since a power motor is driven, and supplies a direct-current-conversion-into-ac means to a power motor, Since it shall consist of a direct-current-alternating current transducer for auxiliary machinery motors changed into the alternating current supplied to an auxiliary machinery motor The alternating current supplied to a power motor and the alternating current supplied to an auxiliary machinery motor can be controlled separately, and power consumed by the power motor and power consumed by the auxiliary machinery motor can be made separate. Therefore, according to the fuel cell power plant concerning claim 9, further, it is a short time and the charge which can consume a charge on the both sides of a power motor and an auxiliary machinery motor, for example, is generated after a generation-of-electrical-energy halt of a fuel cell etc. can be discharged certainly.
[0041] According to the fuel cell power plant concerning claim 10, it has the auxiliary machinery besides a power motor further, and the above-mentioned motor circuit consists of a power motor used as the source of power, is established in the output side of the above-mentioned direct-current-voltage conversion means, changes the magnitude of the direct current outputted from the above-mentioned direct-current-voltage conversion means, and is further equipped with a direct-current-voltage conversion means to supply the above-mentioned auxiliary machinery.
[0042] Further, it is a short time and the charge which can control the charge consumption in auxiliary machinery, for example, is generated after a generation-of-electrical-energy halt of a fuel cell etc. can be discharged certainly. Moreover, since a charge can be consumed using the auxiliary machinery faced and used for driving a power motor according to the fuel cell power plant concerning this claim 10, it is not necessary to prepare the resistance which discharges the output voltage from a fuel cell, for example after a halt of a fuel cell etc., and a miniaturization and low-cost-izing of equipment can be realized.
[0043] Since a direct-current-conversion-into-ac means is controlled to consider as the alternating current value to which a motor circuit does not operate according to the fuel cell power plant concerning claim 11, when unnecessary, it can prevent operating a motor circuit.
[0044] While being able to prevent operating a motor circuit when unnecessary since only auxiliary machinery is operated while controlling a direct-current-conversion-into-ac means to consider as the alternating current value to which a motor circuit does not operate according to the fuel cell power plant concerning claim 12, discharge by auxiliary machinery is realizable.
[0045] Since according to the fuel cell power plant concerning claim 13 it considered as the configuration equipped with two or more direct-current-conversion-into-ac means while having two or more discharge means, the alternating current supplied to each discharge means can be controlled, a charge can be consumed with two or more discharge means, it is a short time further and the charge generated after a generation-of-electrical-energy halt of a fuel cell can be discharged certainly.
[0046] Can make the fuel gas which generated with a fuel reforming vessel since a fuel cell made supply and generate the fuel gas which has the configuration further equipped with the fuel reforming machine which takes out the hydrogen which reforms a predetermined fuel and is supplied to a fuel cell, for example, took out with the fuel reforming vessel from residue of a predetermined fuel after the generation-of-electrical-energy halt of a fuel cell etc. according to the fuel cell power plant concerning claim 14 able to generate with a fuel cell, and it can discharge with a discharge means.
[0047] Since it considered as the configuration equipped with a power are recording means to accumulate the power generated with the fuel cell, and the relay circuit which supplies the direct current outputted from the direct-current-voltage conversion means to a power are recording means according to the fuel cell power plant concerning claim 15 The charge generated after the generation-of-electrical-energy halt of a fuel cell etc. can be accumulated in a power are recording means by controlling the closing motion to the power are recording means of a relay circuit. For example, while being able to discharge further the charge generated after a generation-of-electrical-energy halt of a fuel cell etc. certainly [are a short time and], improvement in fuel consumption can

required relay circuit and a power are recording means are used when a fuel cell system is constituted, it is not necessary to prepare the resistance which discharges the output voltage from a fuel cell, for example after a halt of a fuel cell etc., and a miniaturization and low-cost-izing of equipment can be realized.

[0048] According to the fuel cell power plant concerning claim 16, it has a configuration equipped with a power accumulated dose detection means to detect the power accumulated dose of a power are recording means. Since a relay circuit is controlled to carry out an electric power supply to a power are recording means based on the power accumulated dose detected with the power accumulated dose detection means While accumulating a charge according to the accumulated dose of a power are recording means, being able to discharge a charge and being able to discharge certainly [are a short time and] with other means, improvement in the further fuel consumption can be aimed at.

[0049] Since according to the fuel cell power plant concerning claim 17 it faces suspending a generation of electrical energy of a fuel cell and a current is made to supply and discharge for a discharge means, after suspending a generation of electrical energy of a fuel cell, the power at the time of making fuel gas and oxidant gas which remain in a fuel cell generate can be discharged.

[0050]

[Embodiment of the Invention] Hereafter, a drawing is made reference and the gestalt of operation of this invention is explained to a detail.

[0051] The configuration of the fuel cell power plant 1 which applied this invention as the 1st operation gestalt using [configuration of fuel cell power plant 1 concerning 1st operation gestalt] drawing 1 is explained. The fuel cell power plant 1 concerning the 1st operation gestalt is carried in the fuel cell car which makes a fuel cell the source of a generation of electrical energy, and a fuel cell car system is equipped with it.

[0052] The fuel cell power plant 1 is equipped with a fuel cell 10, a relay box 11, a chopper 12, the 2nd relay 13, and the discharge resistance 14.

[0053] The fuel cell power plant 1 is equipped with the control section which controls the fuel cell power plant 1 concerned, and this control section controls a fuel cell car system in generalization, when a fuel cell power plant 1 is carried in a fuel cell car system etc. Each part is that actuation is controlled by the control section, and, specifically, carries out supply for the load of the power generated with the fuel cell 10, and discharge. In addition, about the contents of processing of this control section, it mentions later.

[0054] A fuel cell 10 consists of two or more fuel cell structures which ****(ed) with the separator the fuel cell structure which opposite-**(ed) the fuel electrode and the oxidizer pole for example, on both sides of the solid-state polyelectrolyte film. a fuel cell 10 -- hydrogen -- rich fuel gas generates electricity by making the hydrogen which is supplied and is contained in the fuel gas supplied, and the oxygen in air react electrochemically.

[0055] The relay box 11 consists of two 1st relay 15a connected to the positive electrode and negative electrode of a fuel cell 10, and 1st relay 15b. Each is connected to the fuel cell 10 at the serial, and each 1st relay 15 is controlled by the control section to open and close the contact of the circuit which supplies power to a latter load from a fuel cell 10.

[0056] The chopper 12 is equipped with 16 ("IGBT16" is called hereafter.) and voltage sensors 17, such as IGBT (Insulated Gate Bipolar Transistor), GTBT, etc. which are the solid-state-switching component by which the series connection was carried out to 1st relay 15a, and a current sensor 18. A control section inputs the electrical-potential-difference value and current value which were detected by the voltage sensor 17 and the current sensor 18 as a sensor signal while it outputs a control signal to IGBT16 and controls actuation.

[0057] The 2nd relay 13 opens and closes the contact of the circuit which supplies power to the latter discharge resistance 14. A switching action [as opposed to the discharge resistance 14 in this 2nd relay 13] is controlled by the control signal from a control section.

[0058] The discharge resistance 14 discharges by supplying the charge generated by the generation of electrical energy by the residual hydrogen and residual oxygen of a fuel cell 10 through a relay box 11, a chopper 12, and the 2nd relay 13.

[0059] furthermore -- again -- the fuel cell 10 of a fuel cell power plant 1 -- hydrogen -- in order to

supply rich gas -- fuels, such as natural gas and a methanol, -- hydrogen -- you may have the fuel reformer reformed in rich gas.
[0060] "Procedure of the system stop processing of a control section performed at the time of the fuel cell system stop of the" fuel cell power plant 1 of the fuel cell power plant 1 concerning the 1st operation gestalt of operation is explained using the flow chart shown in drawing 2 .
[0061] In step S1, when it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S2 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S1 is repeated, and it performs.
[0062] In step S2, a control section makes a closed state the 1st two relay 15a and 15b of a relay box 11, and it controls the 2nd relay 13 to a closed state continuously. Furthermore, a control section operates IGBT16 so that duty (Duty) control which outputs the alternating current which repeats ON and OFF intermittently may be carried out, it makes it flow through the discharge resistance 14, and makes discharge start.
[0063] In the following step S3, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the output of IGBT16 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value set to the fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the Duty ratio of the current outputted from IGBT16, and flows to the discharge resistance 14].
[0064] In the following step S4, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the detected fuel cell current value with the predetermined set point. A control section advances processing to step S5, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S3.
[0065] This step S4 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 1 is carried. For example, in a certain fuel cell car system, the fuel cell current at the time of a system stop is about 0.5A, and the set point is set as about 0.1A.
[0066] In step S5, while making a control section into the OFF state which opened the 1st relay 15 and the 2nd relay 13, IGBT16 is also changed into an OFF (output halt) condition, and it terminates the discharge actuation by the discharge resistance 14 for it.
[0067] In the following step S6, a control section terminates the halt operating sequence of a fuel cell system.
[0068] According to the fuel cell power plant 1 which carries out actuation which was mentioned above, the current which flows IGBT16 to the discharge resistance 14 by controlling by the control section in a duty ratio can be controlled, and the charge generated by the hydrogen which remains in a fuel cell 10 at the time of a halt of a fuel cell 10 can be discharged quickly and certainly.
[0069] The configuration of the fuel cell power plant 20 which applied this invention to [configuration of fuel cell power plant 20 concerning 2nd operation gestalt] drawing 3 as the 2nd operation gestalt is explained. In addition, the same part as an above-mentioned operation gestalt omits the detailed explanation by ****** which attaches the same sign.
[0070] A fuel cell power plant 20 is changed to the 2nd relay 13 of the fuel cell power plant 1 concerning the 1st operation gestalt, and the discharge resistance 14, and has the composition of having connected the inverter 21 and the motor 24 to the latter part of a chopper 12.
[0071] An inverter 21 changes into alternating current power the direct current power which consisted of IGBT22 and IGBT23 and was outputted from the chopper 21, and operates the latter motor 24.
[0072] A motor 24 is a motor and is made to energize with the alternating current power changed by the inverter 21. This motor 24 is a power motor for driving a car in the fuel cell car system by which a fuel cell power plant 20 is carried etc.
[0073] Moreover, the fuel cell power plant 20 is equipped with the control section which controls each part, and this control section controls a fuel cell car system in generalization, when a fuel cell power plant 20 is carried in a fuel cell car system etc.

[0074] The procedure of the 1st, 2nd, and 3rd system stop processing of the control section at the time of the fuel cell system stop of a fuel cell power plant 20 is shown in "actuation of fuel cell power plant 20 concerning 2nd operation gestalt" drawing 4 , drawing 5 , and drawing 6 .
[0075] When it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S12 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S11 repeats in step S11 in the 1st system stop processing shown in "1st system stop processing" drawing 4 , and it performs.
[0076] A control section makes a closed state the 1st two relay 15a and 15b of a relay box 11, a control section operates further IGBT22 and IGBT23 of IGBT16 of a chopper 12, and an inverter 21, and discharge is made to start by energizing a motor 24 in step S12.
[0077] In the following step S13, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, if the electrical potential difference of a fuel cell 10 becomes smaller than a predetermined electrical potential difference, for example, the minimum electrical-potential-difference value set to the fuel cell 10, it will advance processing to step S14, when the electrical potential difference of a fuel cell 10 is larger than a predetermined electrical potential difference, holds actuation of step S12 and continues discharge.
[0078] In step S14, IGBT22 and IGBT23 of IGBT16 of a chopper 12 and an inverter 21 are changed into an open condition, and stop energization of a motor 24, and a control section terminates discharge actuation for them, while changing the 1st relay 15a and 15b into an open condition.
[0079] In the following step S15, a control section terminates the halt operating sequence of a system.
[0080] Since the fuel cell power plant 20 which performs such 1st system stop processing does not need to prepare the load for discharge by performing discharge by the motor 24, it is small and can make equipment low cost.
[0081] In step S21 in the 2nd system stop processing shown in "2nd system stop processing" drawing 5 , when it is judged that the halt actuation instruction to a system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S22 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S21 is repeated, and it performs.
[0082] In step S22, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, while making a control section into the ON state which operated IGBT16 of a chopper 12, discharge is made to start by operating IGBT22 and IGBT23 of an inverter 21 by carrying out intermittent duty control, and energizing them on a motor 24 further.
[0083] In step S23, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the output of IGBT22 and IGBT23 of an inverter 21 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value of a fuel cell 10. That is, a control section carries out adjustable [of the current value which flows on a motor 24 by controlling IGBT22 and IGBT23 and controlling a duty ratio].
[0084] In step S24, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the predetermined set point with the detected fuel cell current value. A control section advances processing to step S25, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S23.
[0085] This step S24 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 1 is carried.
[0086] In step S25, while making a control section into the OFF state which changed the 1st relay 15a and 15b into the open condition, IGBT22 and IGBT23 of IGBT16 of a chopper 12 and an inverter 21 are made into the OFF state changed into the open condition, and stop the energization to a motor 24, and it terminates discharge actuation for them.
[0087] In step S26, a control section terminates the halt operating sequence of a system.
[0088] Thus, in a fuel cell power plant 20, the current which flows on a motor 24 can be controlled

by carrying out duty control of IGBT22 and IGBT23, and quick and positive discharge can be carried out.

[0089] When it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S32 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S31 repeats in step S31 in the 3rd system stop processing shown in "3rd system stop processing" drawing 6 , and it performs.

[0090] In step S32, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, discharge is made to start by making a control section into the ON state which operated IGBT16 of a chopper 12, operating IGBT22 and IGBT23 of an inverter 21 by carrying out intermittent duty control, and energizing them on a motor 24 further.

[0091] In the following step S33, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the output of IGBT22 and IGBT23 of an inverter 21 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value set to the fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT22 and IGBT23, and flows on a motor 24].

[0092] In step S34, whether torque has occurred on the motor 24 by the sensor which is not illustrated judges a control section, when torque has occurred, it advances processing to step S35, and when torque has not occurred, it advances processing to step S38.

[0093] In step S35, since torque has occurred on the motor 24, a control section is made into the current value which is extent which controls the duty ratio of IGBT22 and IGBT23 of an inverter 21, and torque does not generate on a motor 24, and stops generating of torque. That is, the control means of a motor 24 is changed into constant-voltage control from constant current control.

[0094] In the following step S36, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, if the electrical potential difference of a fuel cell 10 becomes less smaller [a control section] than a predetermined electrical potential difference, for example, the minimum electrical-potential-difference value set to the fuel cell 10, it will advance processing to step S37, and when the electrical potential difference of a fuel cell 10 is smaller than a predetermined electrical potential difference, it returns processing to step S33.

[0095] In step S37, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the output of IGBT22 and IGBT23 of an inverter 21 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value set to the fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT22 and IGBT23, and flows on a motor 24].

[0096] In the following step S38, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the detected fuel cell current value with the predetermined set point. A control section advances processing to step S39, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S33.

[0097] This step S38 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 1 is carried.

[0098] In step S39, while making a control section into the OFF state which changed the 1st relay 15a and 15b into the open condition, IGBT22 and IGBT23 of IGBT16 of a chopper 12 and an inverter 21 are made into the OFF state changed into the open condition, and stop the energization to a motor 24, and it terminates discharge actuation for them.

[0099] In the following step S40, a control section terminates the halt operating sequence of a fuel cell system.

[0100] In the fuel cell power plant 20 which operates by such 3rd system control processing, since the fuel cell current which is extent which torque does not generate is supplied to a motor 24,

electrodischarge treatment of a fuel cell 10 can be safely performed so that a motor 24 cannot rotate after a fuel cell system stop.

[0101] Moreover, according to this fuel cell power plant 20, since a motor 24 is not made to generate torque, at the time of a system stop, a motor 24 can abolish possibility of operating suddenly and can raise safety.

[0102] The configuration of the fuel cell power plant 30 which applied this invention to [configuration of fuel cell power plant 30 concerning 3rd operation gestalt] drawing 7 as the 3rd operation gestalt is shown. In addition, in explanation of a fuel cell power plant 30, the same part as an above-mentioned operation gestalt omits the detailed explanation by ****** which attaches the same sign.

[0103] The fuel cell power plant 30 has composition which discharges the charge generated from the fuel cell 10 using the coil 34 and IGBT32 which were arranged in the latter part of IGBT16 in a chopper 31. A load, a dc-battery, etc. which are not illustrated are arranged in the latter part of this chopper 31.

[0104] With this fuel cell power plant 30, system stop processing is carried out by controlling the 1st relay 15 and actuation of IGBT16 and IGBT32 by the control section which is not illustrated.

[0105] The procedure of the 1st and 2nd system stop processing of the control section at the time of the fuel cell system stop of a fuel cell power plant 30 is shown in "actuation of fuel cell power plant 30 concerning 3rd operation gestalt" drawing 8 , and drawing 9 .

[0106] When it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S42 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S41 repeats in step S41 in the 1st system stop processing shown in "1st system stop processing" drawing 8 , and it performs.

[0107] In step S42, a control section is controlled to the ON state which makes a closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, a control section operates IGBT16 and IGBT32 of a chopper 31, and discharge is made to start by storing a current in a coil 34 as energy at a sink and a coil 34.

[0108] In step S43, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, if the electrical potential difference of a fuel cell 10 becomes smaller than a predetermined electrical potential difference, for example, the minimum electrical-potential-difference value set to the fuel cell 10, it will advance processing to step S44, when the electrical potential difference of a fuel cell 10 is larger than a predetermined electrical potential difference, holds actuation of step S42 and continues discharge.

[0109] In step S44, while making a control section into the OFF state which changed the 1st relay 15 into the open condition, IGBT16 and IGBT32 of a chopper 31 are made into the OFF state changed into the open condition, and it terminates discharge actuation with a coil 34 for them.

[0110] In step S45, a control section terminates the halt operating sequence of a fuel cell system.

[0111] The fuel cell power plant 30 which carries out actuation according to such 1st system stop processing is supplying a fuel cell current to the coil 34 which it has inevitably in a chopper 31, and carrying out electrodischarge treatment to it, and can realize miniaturization of equipment, and low cost-ization.

[0112] When it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S52 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S51 repeats in step S51 in the 2nd system stop processing shown in "2nd system stop processing" drawing 9 , and it performs.

[0113] In step S52, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, a control section operates IGBT16 and IGBT32 of a chopper 31 by carrying out intermittent duty control, and discharge is made to start by storing a current in a coil 34 as energy at a sink and a coil 34.

[0114] In the following step S53, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the output of IGBT16 and IGBT32 of a chopper 31 to become beyond an electrical-potential-difference value with the fixed electrical

potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value of a fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT16 and IGBT32, and flows in a coil 34].

[0115] In step S54, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the predetermined set point with the detected fuel cell current value. When the detected fuel cell current is below the set point, processing is advanced to step S55, and when it is beyond the set point, processing is returned to step S53.
[0116] This step S54 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 30 is carried.
[0117] In step S55, while making a control section into the OFF state which changed the 1st relay 15 into the open condition, IGBT16 and IGBT32 of a chopper 31 are made into the OFF state changed into the open condition, and it terminates discharge actuation with a coil 34 for them.
[0118] In step S56, a control section terminates the halt operating sequence of a fuel cell system.
[0119] In the fuel cell power plant 30 which operates according to such 2nd system stop processing, the current which flows in a coil 34 can be controlled by the thing which control the duty ratio of IGBT16 and IGBT32 and to do for duty control, and quick and positive discharge can be carried out.

[0120] The configuration of the fuel cell power plant 40 which applied this invention to [configuration of fuel cell power plant 40 concerning 4th operation gestalt] drawing 10 as the 4th operation gestalt is shown. In addition, about the same part as an above-mentioned operation gestalt, the detailed explanation is omitted by ****** which attaches the same sign.
[0121] The fuel cell power plant 40 has the composition that the auxiliary machinery motor 44 connected with the inverter 41 with which it comes to add IGBT42 and IGBT43 to an inverter 21 further IGBT42 and IGBT43 was added to the fuel cell power plant 20 shown as the 2nd operation gestalt. Let a motor 24 be the power motor 24 used as the source of power of a fuel cell system especially with this 4th operation gestalt.
[0122] Although, as for the motor, **** serves as [that an inverter 41 makes it operate] only the power motor 24 and the auxiliary machinery motor 44 here, an inverter 41 can operate two or more motors.
[0123] In the power motor 24 which functions as a motor of operation, the auxiliary machinery motor 44 is a motor which makes other function parts which constitute a system drive, when it differs and a fuel cell power plant 40 is carried for example, in a fuel cell car system.
[0124] Moreover, the fuel cell power plant 40 is equipped with the control section which controls each part, and this control section controls a fuel cell car system in generalization, when a fuel cell power plant 40 is carried in a fuel cell car system etc.
[0125] The procedure of system stop processing of the control section at the time of the fuel cell system stop of a fuel cell power plant 40 is shown in "actuation of fuel cell power plant 40 concerning 4th operation gestalt" drawing 11 .
[0126] In step S61, when it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S62 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S61 is repeated, and it performs.
[0127] In step S62, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, discharge is made to start by a control section operating IGBT16 of a chopper 12, and operating IGBT22, IGBT23, IGBT42, and IGBT43 of an inverter 41 by carrying out intermittent duty control, and making the power motor 24 and the auxiliary machinery motor 44 energize them further.
[0128] In the following step S63, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the duty ratio of the output of IGBT22, IGBT23, IGBT42, and IGBT43 of an inverter 41 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value set to the fuel cell 10. At this time, by the power motor 24, the

duty ratio of the output of IGBT22, IGBT23, IGBT42, and IGBT43 is controlled by the auxiliary machinery motor 44 so that the current which is extent which torque generates flows, so that torque does not occur.

[0129] In step S64, whether torque has occurred on the auxiliary machinery motor 44 and the power motor 24 by the sensor which is not illustrated judges a control section, when torque has occurred, it advances processing to step S65, and when torque has not occurred, it advances processing to step S68.

[0130] In step S65, since torque has occurred on the power motor 24 and the auxiliary machinery motor 44, a control section makes small the current value which controls the duty ratio of the output from IGBT22, IGBT23, IGBT42, and IGBT43 of an inverter 41, and flows on the power motor 24 and the auxiliary machinery motor 44, and stops generating of torque. That is, from constant current control, the control means of the power motor 24 and the auxiliary machinery motor 44 is changed into constant-voltage control.

[0131] In the following step S66, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, if the electrical potential difference of a fuel cell 10 becomes less smaller [a control section] than a predetermined electrical potential difference, for example, the minimum electrical-potential-difference value set to the fuel cell 10, it will advance processing to step S67, when the electrical potential difference of a fuel cell 10 is smaller than a predetermined electrical potential difference, returns processing to step S63, and continues discharge by the power motor 24 and the auxiliary machinery motor 44.

[0132] In the following step S67, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the duty ratio of the output of IGBT22, IGBT23, IGBT42, and IGBT43 of an inverter 41 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value set to the fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT22, IGBT23, IGBT42, and IGBT43, and flows on the power motor 24 and the auxiliary machinery motor 44].

[0133] In the following step S68, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the detected fuel cell current value with the predetermined set point. A control section advances processing to step S69, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S63.

[0134] This step S68 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 1 is carried.

[0135] In step S69, while making a control section into the OFF state which changed the 1st relay 15 into the open condition, IGBT22, IGBT23, IGBT42, and IGBT43 of IGBT16 of a chopper 12 and an inverter 41 are made into the OFF state changed into the open condition, and it terminates discharge actuation by the power motor 24 and the auxiliary machinery motor 44 for them.

[0136] In step S70, a control section terminates the halt operating sequence of a fuel cell system.

[0137] The fuel cell power plant 40 which operates according to such system stop processing can perform discharge of residual hydrogen on insurance and an effectiveness target by being able to realize a miniaturization and low-cost-izing of equipment, performing a torque control further, and making the auxiliary machinery motor 44 generate torque by carrying out electrodischarge treatment on the both sides of the power motor 24 and the auxiliary machinery motor 44.

[0138] In addition, as for the current consumption ratio of the power motor 24 and the auxiliary machinery motor 44, a control section can change for 0 to 100% into arbitration by motor 24 / auxiliary machinery motor 44.

[0139] Moreover, a system may determine the motor by which a control section gives torque, and the motor which does not give torque. For example, although the power motor 24 is not made to generate torque, the motor for compressors for air incorporation and the auxiliary machinery motors 44, such as a motor for cooling intermediation general circulation, are made to generate torque according to a system situation.

[0140] Furthermore, according to this fuel cell power plant 40, since the power motor 24 is not made to generate torque, at the time of a system stop, the power motor 24 can abolish possibility of operating suddenly, and can raise safety.
[0141] The configuration of the fuel cell power plant 50 which applied this invention as [configuration of fuel cell power plant 50 concerning 5th operation gestalt] drawing 12 and the 5th operation gestalt is shown. In addition, about the same part as an above-mentioned operation gestalt, the detailed explanation is omitted by ****** which attaches the same sign.
[0142] The fuel cell power plant 50 has the composition that DC to DC converter 51, the dc-battery 52, and the cooling pump 53 were added to the fuel cell power plant 20 shown as the 2nd operation gestalt.
[0143] DC to DC converter 51 changes a direct current into a predetermined electrical potential difference, and supplies it to the latter cooling pump 53.
[0144] The cooling pump 53 is a pump for cooling a motor 24. An internal motor is made to energize this cooling pump 53 according to the electrical potential difference from DC to DC converter 51, and it supplies the cooling water according to the amount of drives of an internal motor to a motor 24. In addition, although the cooling pump 53 is used here as equipment which operates with DC to DC converter 51, as long as it is equipment which operates by the direct current, you may be what kind of thing.
[0145] Moreover, the fuel cell power plant 50 is equipped with the control section which controls the fuel cell power plant 20 concerned, and this control section controls a fuel cell car system in generalization, when a fuel cell power plant 50 is carried in a fuel cell car system etc.
[0146] In addition, in the fuel cell power plant 50 concerning the 5th operation gestalt, while having the inverter 41 of a configuration as it replaces with an inverter 21 and was shown in drawing 10 , it may have an auxiliary machinery motor, and other auxiliary machinery of the cooling pump 53 may be driven.
[0147] "Actuation of the fuel cell power plant 50 concerning the 5th operation gestalt", next actuation of a fuel cell power plant 50 are explained using the flow chart shown in drawing 13 .
[0148] In step S71, when it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S72 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S71 is repeated, and it performs.
[0149] In step S72, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, a control section operates IGBT16, DC to DC converter 51, and the cooling pump 53 of a chopper 12. Furthermore, IGBT22 and IGBT23 of an inverter 21 are operated by carrying out duty control.
[0150] Thereby, while accumulating the power from DC to DC converter 51 in a dc-battery 52, the cooling pump 53 is supplied, and discharge is made to start by energizing on the cooling pump 53 and a motor 24 with a fuel cell power plant 50.
[0151] In the following step S73, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the duty ratio of the output of IGBT22 and IGBT23 of an inverter 21 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value of a fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT22 and IGBT23, and flows on a motor 24].
[0152] Moreover, in this step S73, a control section carries out duty control of IGBT22 and IGBT23 so that a motor 24 may not be made to generate torque, and it controls DC to DC converter 51 to make the cooling pump 53 generate torque.
[0153] In the following step S74, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the detected fuel cell current value with the predetermined set point. A control section advances processing to step S75, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S73.
[0154] This step S74 is processing judged for terminating discharge actuation of a fuel cell 10, and

the set point used as the criteria of decision changes with systems by which a fuel cell power plant 50 is carried.

[0155] In step S75, while making a control section into the OFF state which changed the 1st relay 15 into the open condition, IGBT22 and IGBT23 of IGBT16 of a chopper 12 and an inverter 21 are made into the OFF state changed into the open condition, and stop actuation of a motor 24, DC to DC converter 51, and the cooling pump 53, and it terminates discharge actuation for them.

[0156] In step S76, a control section terminates the halt operating sequence of a fuel cell system.

[0157] With the fuel cell power plant 50 which operates according to such system stop processing, efficient electrodischarge treatment can be performed by operating not only the motor 24 but DC to DC converter 51, making a dc-battery 52 and/or the cooling pump 53 drive, and carrying out electrodischarge treatment of the residual hydrogen of a fuel cell 10.

[0158] Moreover, since torque is generated with the cooling pump 53 according to this fuel cell power plant 50, without making a motor 24 generate torque, at the time of a system stop, a motor 24 can abolish possibility of operating suddenly and can raise safety.

[0159] The configuration of the fuel cell power plant 60 which applied this invention to [configuration of fuel cell power plant 60 concerning 6th operation gestalt] drawing 14 as the 6th operation gestalt is shown. In addition, about the same part as an above-mentioned operation gestalt, the detailed explanation is omitted by ****** which attaches the same sign.

[0160] A fuel cell power plant 60 is changed to a chopper 12 at the fuel cell power plant 50 shown as the 5th operation gestalt, applies the chopper 61 of a configuration of having removed the current sensor 18 and the coil 34 from the chopper 31 of the fuel cell power plant 30 shown as the 3rd operation gestalt, and has further the composition of having added the relay box 62 equipped with two relays 63, and the rechargeable battery 64.

[0161] Moreover, the fuel cell power plant 60 is equipped with the control section which controls the fuel cell power plant 60 concerned, and this control section controls a fuel cell car system in generalization, when a fuel cell power plant 60 is carried in a fuel cell car system etc.

[0162] In addition, in the fuel cell power plant 50 concerning the 5th operation gestalt, while having the inverter 41 of a configuration as it replaces with an inverter 21 and was shown in drawing 10 , it may have an auxiliary machinery motor, and other auxiliary machinery of the cooling pump 53 may be driven.

[0163] "Actuation of the fuel cell power plant 60 concerning the 6th operation gestalt", next actuation of a fuel cell power plant 60 are explained using the flow chart shown in drawing 15 .

[0164] In step S81, when it is judged that the halt actuation instruction to a fuel cell system is inputted, a control section judges whether it is a halt operating sequence, it advances processing to step S82 when it is judged that the halt operating sequence is performed, and the halt operating sequence is not performed, processing of step S81 is repeated, and it performs.

[0165] In step S82, a control section detects the rate (SOC) of accumulation of electricity of the rechargeable battery 64 detected by the sensor which is not illustrated, and judges whether it is in a full charge condition. If it is not in a full charge condition, processing will be advanced to step S83, and if it is in a full charge condition, processing will be advanced to step S87.

[0166] In step S83, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11, and two relays 63 of a relay box 62. Furthermore, a control section operates IGBT16 of a chopper 12 by carrying out duty control. A control section opens IGBT22 and IGBT23 of an inverter 21 to coincidence, it is made to also suspend actuation of DC to DC converter 51 and the cooling pump 53, and discharge is made to start by charging a rechargeable battery 64.

[0167] In the following step S84, a control section detects the amount of accumulation of electricity of the rechargeable battery 64 detected by the sensor which is not illustrated, and judges whether it is in a full charge condition. If it is not in a full charge condition, processing will be advanced to step S85, and if it is in a full charge condition, processing will be advanced to step S87.

[0168] In step S85, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, controls the output of IGBT16 and IGBT32 of a chopper 61 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value of a fuel cell 10, and

carries out current adjustment and voltage adjustment.
[0169] In step S86, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the detected fuel cell current value with the predetermined set point. A control section advances processing to step S90, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S84.
[0170] In step S87, a control section is controlled to the ON state which made the closed state the 1st two relay 15a and 15b of a relay box 11. Furthermore, a control section operates IGBT16 of a chopper 61, operates DC to DC converter 51, and operates the cooling pump 53. A control section operates IGBT22 and IGBT23 of an inverter 21 by carrying out duty control, and discharge is made to start by energizing on a motor 24 furthermore. Furthermore, a control section makes an OFF state two relays 63 of a relay box 62, and stops the power are recording to a rechargeable battery 64 again.

[0171] Thereby, since SOC is 100% or more, a fuel cell power plant 60 is made into the condition of not performing charge to a rechargeable battery 64, and it performs discharge with a motor 24 and/or the cooling pump 53.
[0172] In the following step S88, a control section detects the electrical potential difference of the fuel cell 10 detected by the voltage sensor 17, and controls the duty ratio of the output of IGBT22 and IGBT23 of an inverter 21 to become beyond an electrical-potential-difference value with the fixed electrical potential difference of a fuel cell 10, for example, the minimum electrical-potential-difference value of a fuel cell 10. That is, a control section carries out adjustable [of the current value which controls the duty ratio of the alternating current outputted from IGBT22 and IGBT23, and flows on a motor 24].
[0173] In the following step S89, a control section detects the fuel cell current outputted from the fuel cell 10 detected by the current sensor 18, and compares the predetermined set point with the detected fuel cell current value. A control section advances processing to step S90, when the detected fuel cell current is below the set point, and when it is beyond the set point, it returns processing to step S88.
[0174] This step S89 is processing judged for terminating discharge actuation of a fuel cell 10, and the set point used as the criteria of decision changes with systems by which a fuel cell power plant 60 is carried.
[0175] In step S90, while making a control section into the OFF state which opened the 1st relay 15 of a relay box 11, and the relay 63 of a relay box 62, IGBT16 and IGBT32 of a chopper 61, and IGBT22 and IGBT23 of an inverter 21 are made into the OFF state changed into the open condition, and stop actuation of the energization to a motor 24, DC to DC converter 51, and the cooling pump 53, and it terminates discharge actuation for them.
[0176] In step S91, a control section terminates the halt operating sequence of a fuel cell system.
[0177] With the fuel cell power plant 60 which operates according to such system stop processing, a rechargeable battery can be added to a fuel cell power plant 50, and energy can be used effectively by performing electrodischarge treatment of a fuel cell 10 also with a rechargeable battery.
[0178] In addition, the current consumption ratio of a motor 24 and the auxiliary machinery motor 44 can change for 0 to 100% into arbitration by motor 24 / auxiliary machinery motor 44.
[0179] As [operation gestalt of others which applied this invention] **** was carried out, the 1st operation gestalt thru/or the 6th operation gestalt which applied this invention explained the electrodischarge treatment for removing residual hydrogen, but this invention may be applied in case the hydrogen generated by the fuel reformer after the shutdown of the system carrying either of the fuel cell power plants 1, 20, 30, 40, 50, and 60 is removed, as shown below.
[0180] For example, suppose that the fuel reformer 70 equipped with the reforming reaction section 71, CO removal section 72, and the combustion section 73 as shown in drawing 16 is connected to a fuel cell 10. Fuels, such as natural gas and a methanol, are supplied to the fuel reformer 70 from a fuel tank 74.
[0181] The hydrogen which reforming of the fuel supplied to the fuel reformer 71 from a fuel tank 74 was carried out to hydrogen in the reforming reaction section 71, and CO was removed in CO removal section 72, and was removed in CO is supplied to a fuel cell 10. The hydrogen which was

not used with a fuel cell 10 is again returned to the fuel reformer 71, and is burned and exhausted in the combustion section 73.

[0182] In such a fuel reformer 70, in a system stop processing sequence, in order to process the fuel which remained in the fuel reforming machine 70 interior, piping, etc., reforming is carried out to hydrogen in the reforming reaction section 71, and hydrogen is generated.

[0183] The hydrogen generated in the fuel reformer 70 in the system stop processing sequence is supplied to a fuel cell 10, and can carry out electrodischarge treatment with the fuel cell power plants 1, 20, 30, 40, 50, and 60 mentioned above.

[0184] Moreover, if the system carrying either of the fuel cell power plants 1, 20, 30, 40, 50, and 60 shifts to a halt operating sequence when it is the configuration that hydrogen is direct supplied to a fuel cell 10 from hydrogen storage equipment 75, as shown in drawing 17 and drawing 18 , the hydrogen which was not used with a fuel cell 10 can carry out electrodischarge treatment with the fuel cell power plants 1, 20, 30, 40, 50, and 60 mentioned above.

[0185] In addition, the gestalt of above-mentioned operation is an example of this invention. For this reason, if this invention is range which does not deviate from the technical thought concerning this invention even if it is not limited to an above-mentioned operation gestalt and is except the gestalt of this operation, it is natural. [of various modification being possible according to a design etc.]

[0186] That is, although an example mentioned above explained the case where energized a direct current when discharging with discharge resistance, a coil, and a cooling pump, and alternating current was energized when discharging by the power motor or the auxiliary machinery motor, of course, it is not limited as a direct current and alternating current about the case where each discharge means is used.

[0187] Furthermore, although an example mentioned above explained the case where it had the inverter of the number to which the discharge means was made to correspond, it may not be limited to this, but two or more inverters may be used to the discharge means of 1, and, of course, the inverter of 1 may be used to further two or more discharge means.

[Translation done.]

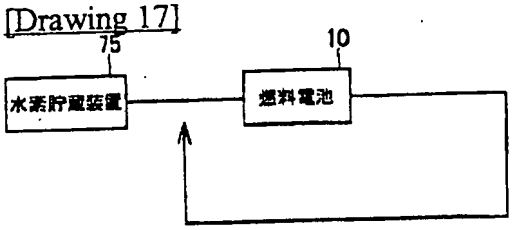
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 1st of this invention.
[Drawing 2] It is a flow chart for explaining electrodischarge treatment actuation of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 3] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 2nd of this invention.
[Drawing 4] It is a flow chart for explaining electrodischarge treatment actuation of the 1st of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 5] It is a flow chart for explaining electrodischarge treatment actuation of the 2nd of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 6] It is a flow chart for explaining electrodischarge treatment actuation of the 3rd of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 7] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 3rd of this invention.
[Drawing 8] It is a flow chart for explaining electrodischarge treatment actuation of the 1st of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 9] It is a flow chart for explaining electrodischarge treatment actuation of the 2nd of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 10] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 4th of this invention.
[Drawing 11] It is a flow chart for explaining electrodischarge treatment actuation of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 12] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 5th of this invention.
[Drawing 13] It is a flow chart for explaining electrodischarge treatment actuation of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 14] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a gestalt of operation of the 6th of this invention.
[Drawing 15] It is a flow chart for explaining electrodischarge treatment actuation of the hydrogen which remained in the fuel cell of this fuel cell power plant.
[Drawing 16] It is a block diagram for explaining the important section configuration of a fuel reformer.
[Drawing 17] In the fuel cell power plant shown as a gestalt of operation of this invention, it is the 1st block diagram for explaining signs that hydrogen is directly supplied to a fuel cell.
[Drawing 18] In the fuel cell power plant shown as a gestalt of operation of this invention, it is the 2nd block diagram for explaining signs that hydrogen is directly supplied to a fuel cell.
[Drawing 19] It is a block diagram for explaining the important section configuration of the fuel cell power plant shown as a Prior art.
[Description of Notations]
1, 20, 30, 40, 50, 60 Fuel cell power plant
10 Fuel Cell
11 Relay Box
12 Chopper
13 2nd Relay
14 Discharge Resistance
15 1st Relay
16 IGBT
17 Voltage Sensor
18 Current Sensor
21 Inverter

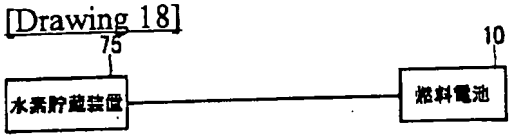
23 IGBT
24 Power Motor
32 IGBT
31 Chopper
34 Coil
41 Inverter
42 IGBT
43 IGBT
44 Auxiliary Machinery Motor
51 DC to DC Converter
52 Dc-battery
53 Cooling Pump
61 Chopper
62 Relay Box
63 Relay
64 Rechargeable Battery

DRAWINGS

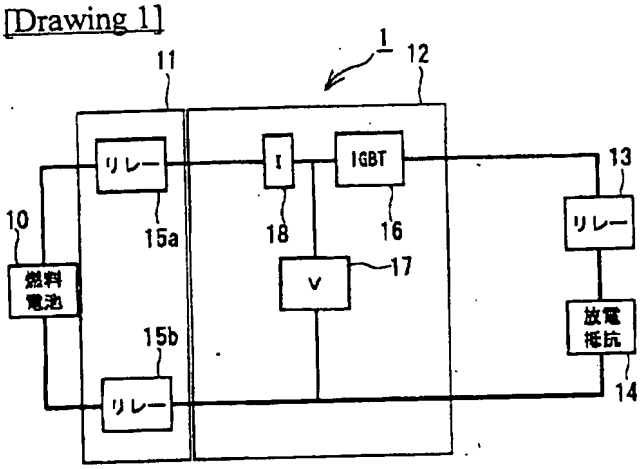
[Drawing 17]



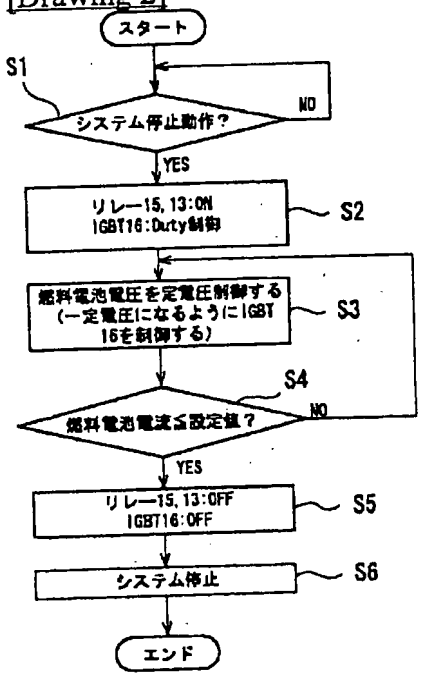
[Drawing 18]



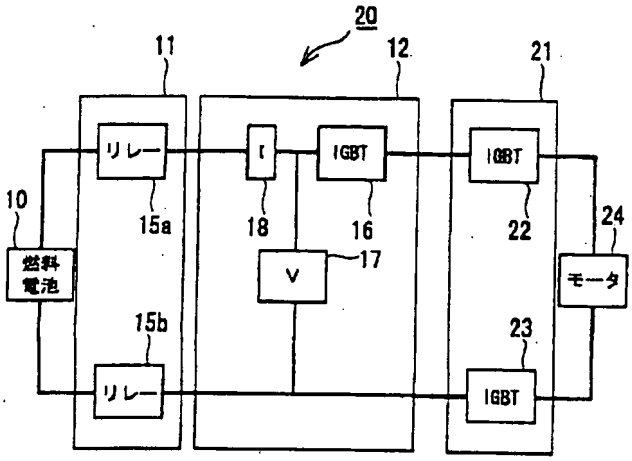
[Drawing 1]



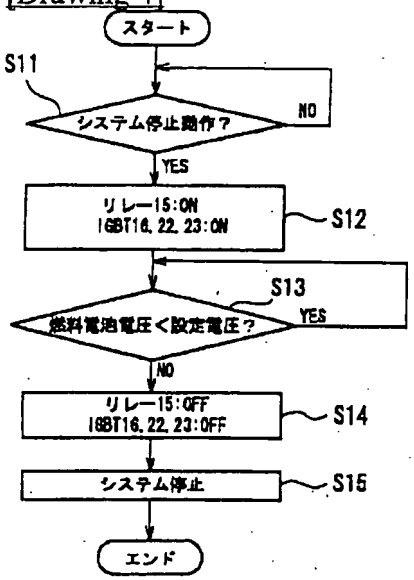
[Drawing 2]



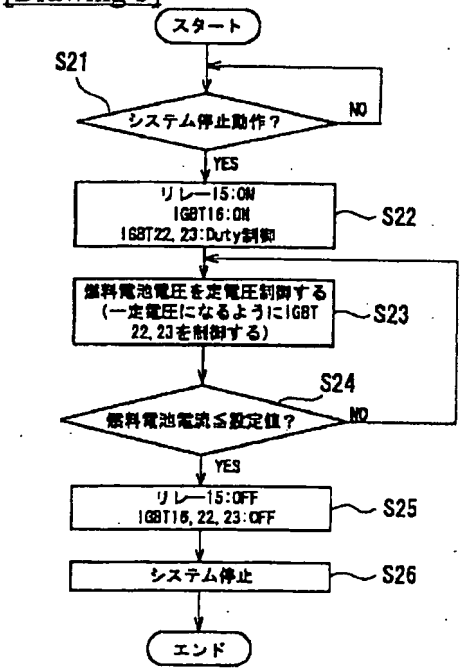
[Drawing 3]



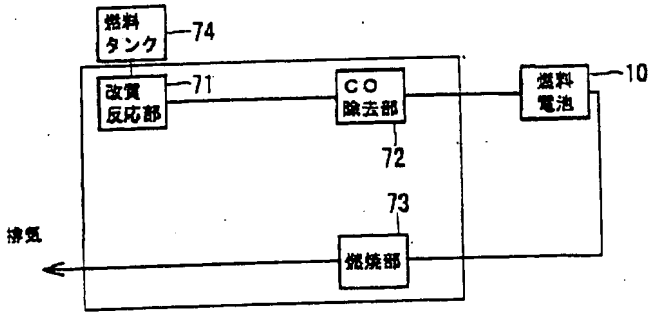
[Drawing 4]



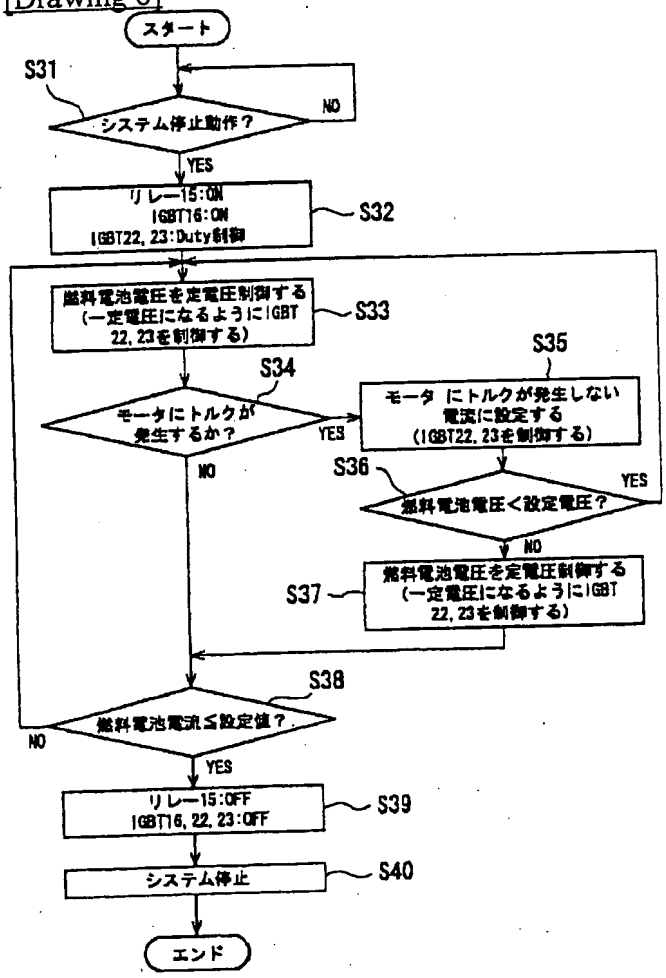
[Drawing 5]



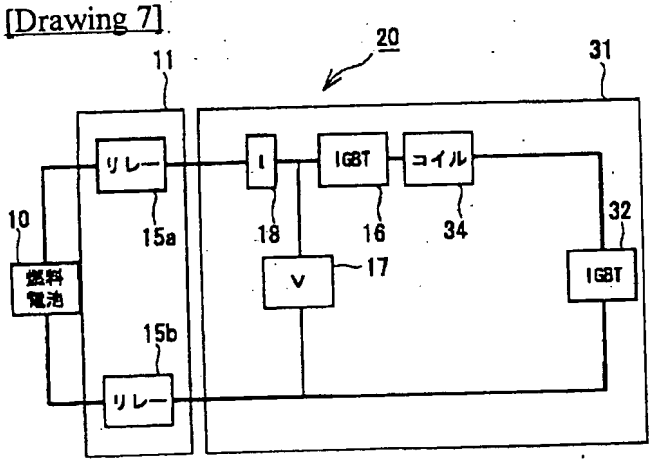
[Drawing 16]



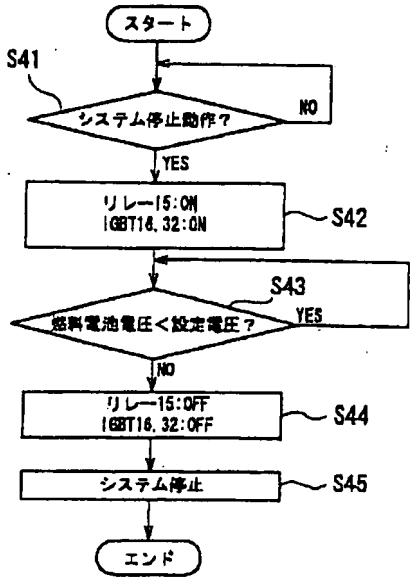
[Drawing 6]



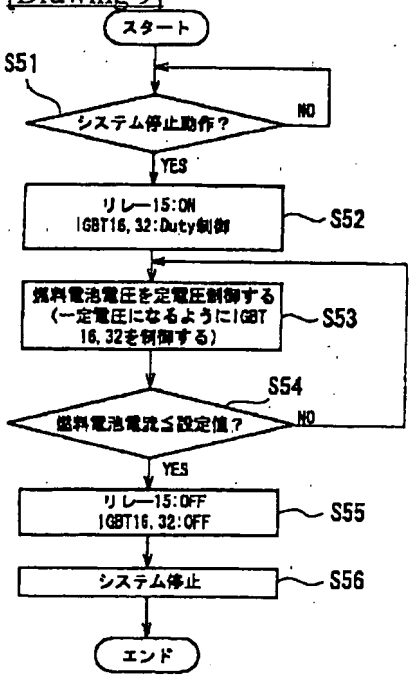
[Drawing 7]



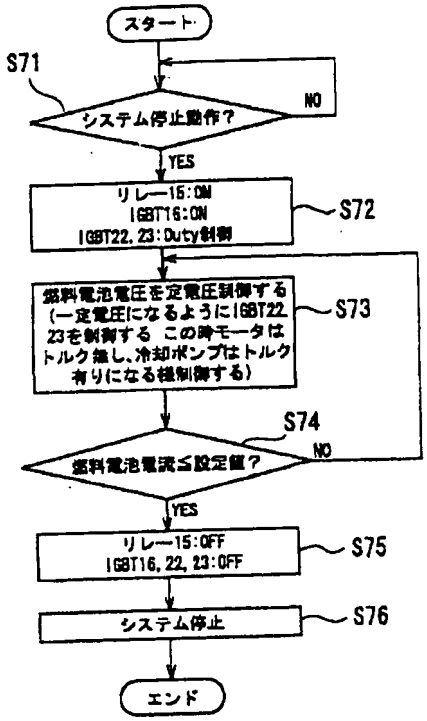
[Drawing 8]



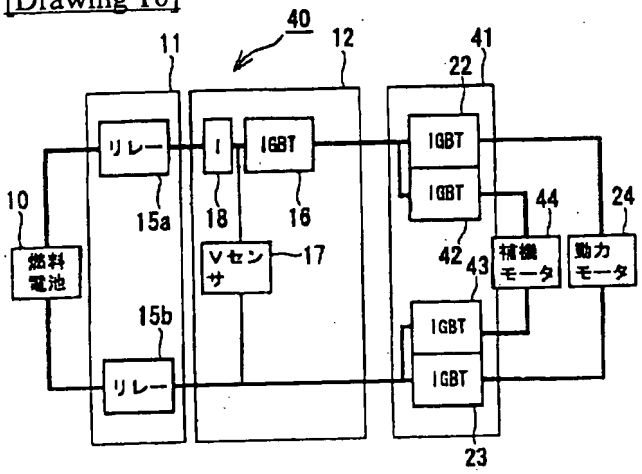
[Drawing 9]



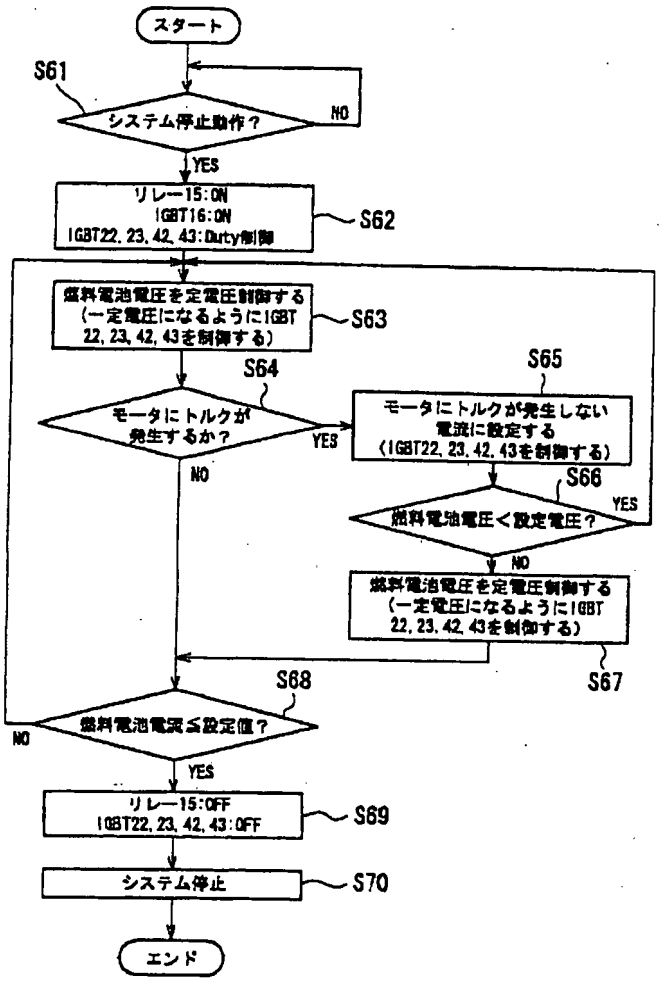
[Drawing 13]



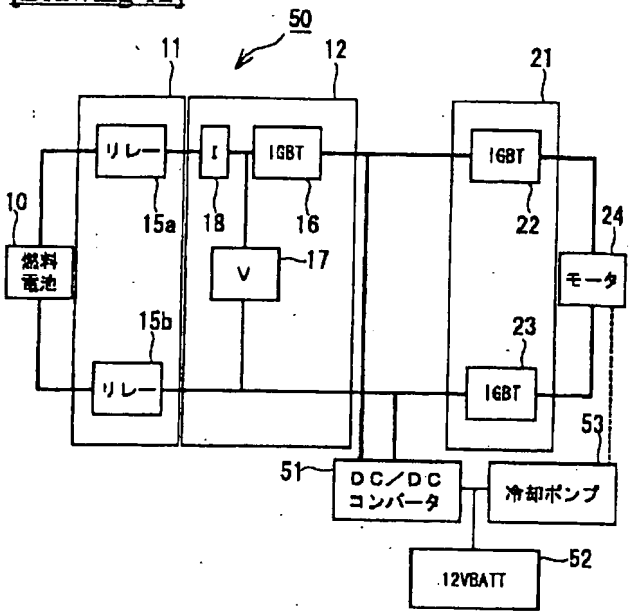
[Drawing 10]



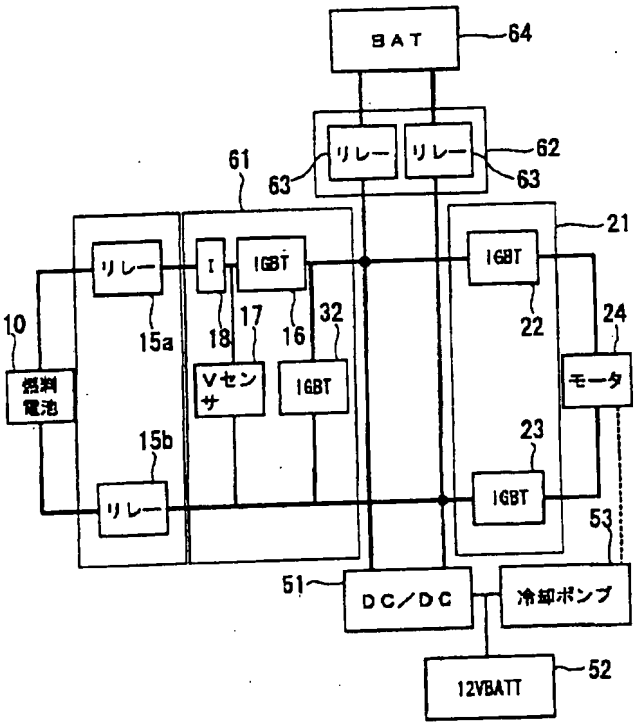
[Drawing 11]



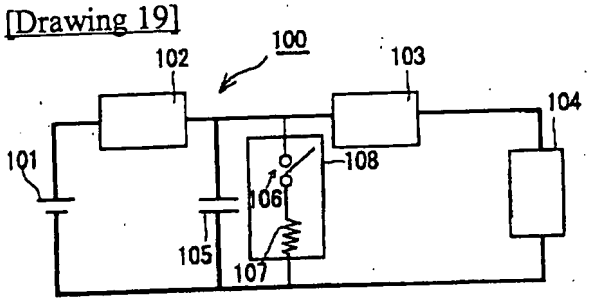
[Drawing 12]



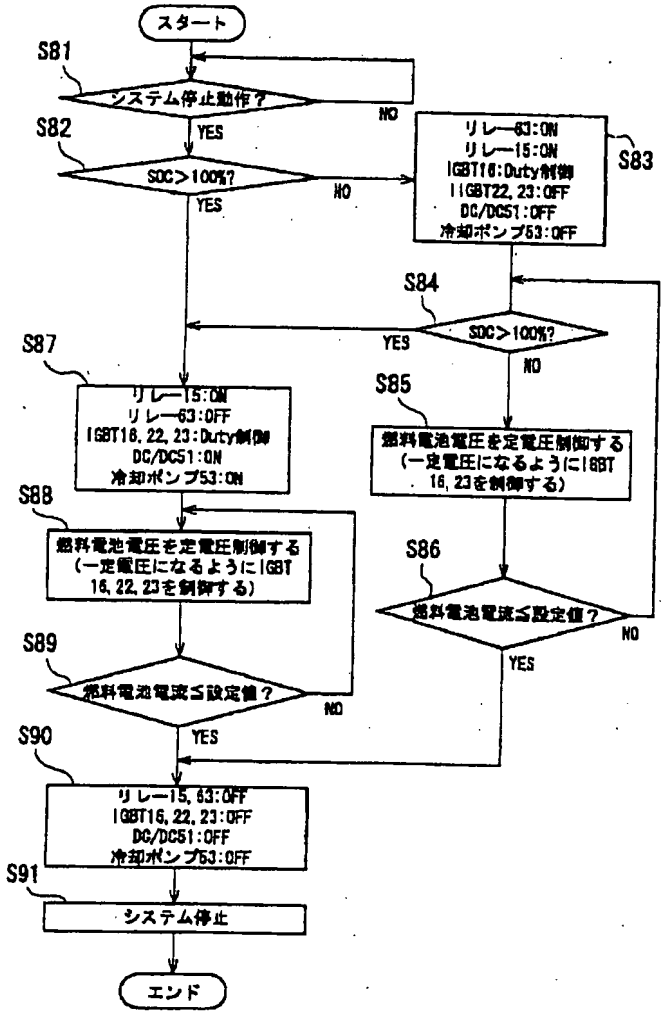
[Drawing 14]



[Drawing 19]



[Drawing 15]


スタート
S81
システム停止動作？
NO
YES
S82
SOC＞100%?
NO
YES
リレー63:ON
リレー15:ON
IGBT16:Duty制御
IGBT22, 23:OFF
DC/DC51:OFF
冷却ポンプ53:OFF
S83
S84
SOC＞100%?
YES
NO
S87
リレー15:ON
リレー63:OFF
IGBT16, 22, 23:Duty制御
DC/DC51:ON
冷却ポンプ53:ON
S85
燃料電池電圧を定電圧制御する
（一定電圧になるようにIGBT
16, 23を制御する）
S88
燃料電池電圧を定電圧制御する
（一定電圧になるようにIGBT
16, 22, 23を制御する）
S86
燃料電池電流≦設定値？
NO
YES
S89
燃料電池電流≦設定値？
NO
YES
S90
リレー15, 63:OFF
IGBT16, 22, 23:OFF
DC/DC51:OFF
冷却ポンプ53:OFF
S91
システム停止
エンド